Chronic plasma cell osteomyelitis of the humerus associated with *Shigella* and *Flavobacterium*

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Chronic sclerosing osteomyelitis is an uncommon condition that results in dense thickening of bone without the typical features of infection. Because patients do not have signs of infection, diagnosis may prove difficult, and the differential should include neoplasm. Although the radiographic, histologic, bacteriologic, and progressive features of this condition are nonspecific, different subtypes of sclerosing osteomyelitis have been described.[3,7,8,13,15]

Equally uncommon is extraintestinal disease linked to *Shigella* or *Flavobacterium*. A review of the literature since 1936 revealed only 4 published reports of human bone infection caused by the *Shigella* species and none associated with the *Flavobacterium* species.[1,14,16,17] This report describes a case of sclerosing plasma cell osteomyelitis in a long bone associated with *Shigella* and *Flavobacterium*.

CASE REPORT

A 34-year-old woman presented with a 2-year history of dull, aching pain in the right arm that was worse at night and alleviated with acetaminophen. One month before presentation, she had a single, self-limited episode of excruciating pain in the right upper arm. There was no history of trauma, overuse, or other injury. She reported no gastrointestinal distress, fevers, chills, weight loss, malaise, recent infections, or travel history. She had a 17-year history of asthma that required only intermittent use of a steroid inhaler. She had a remote history of oral steroid use but was not immunocompromised at the time of presentation.

Physical examination of the right shoulder demonstrated no swelling or erythema. The pain was poorly localized to the anterior upper half of her right arm. There was no point tenderness. Range of motion was full, and she was neurovascularly intact distally.

Laboratory findings were normal, including a leukocyte count of 4000 U/L with 32% polymorphonuclear cells, 49% lymphocytes, 10% mononuclear cells, and 9% eosinophils; an erythrocyte sedimentation rate of 4 mm/h; and an alkaline phosphatase of 50 IU.

Radiographs demonstrated 2 lesions in the proximal humerus: a 4.2-cm densely sclerotic, irregular region in the medullary canal at the surgical neck, and a 9-cm sclerotic area with adjacent cortical hypertrophy in the diaphyseal humerus (Figure 1). A 3-phase bone scan showed increased uptake in 2 areas that corresponded with the plain films (Figure 2). A computed tomography scan similarly revealed the 2 sclerotic lesions without any cortical erosion (Figure 3).

An extensile, deltopectoral approach was used to expose the proximal humerus. Adjacent soft tissue and muscle were normal. No signs of suppurative infection, fistula formation, or sequestration were seen. Soft tissue was sent for microbiologic and pathologic work-up. Two cortical windows were made anteriorly, and incisional biopsies were performed. Grossly, the bone was extremely dense and sclerotic. Microbacterial and pathologic specimens were obtained from the sclerotic bone by using a hollow Midas Rex (Medtronic, Fort Worth, Tex) awl. Standard bone biopsy techniques were difficult to use in the densely sclerotic bone found. After meticulous hemostasis, the wound was closed in the standard fashion. A drain was used in line with the incision.

Gram staining of the diaphyseal specimen revealed gram-negative rods, and cultures from the diaphysis were positive for *Shigella* and *Flavobacterium* species. Metaphyseal cultures were sterile. All organisms were sensitive to ciprofloxacin.

Histologically, the metaphyseal specimen showed reactive and sclerotic cortical and cancellous bone with remodeling activity and occasional plasma cells and Russell's bodies, consistent with nonspecific bony proliferation and resorption. The marrow of the diaphyseal lesion was replaced by a marked, chronic inflammatory infiltrate of numerous mononuclear and binucleated plasma cells and histiocytes intermixed with occasional polymorphonuclear cells (Figure 4). Focal peritrabecular fibrosis was present. Furthermore, the surrounding soft tissue demonstrated simi-

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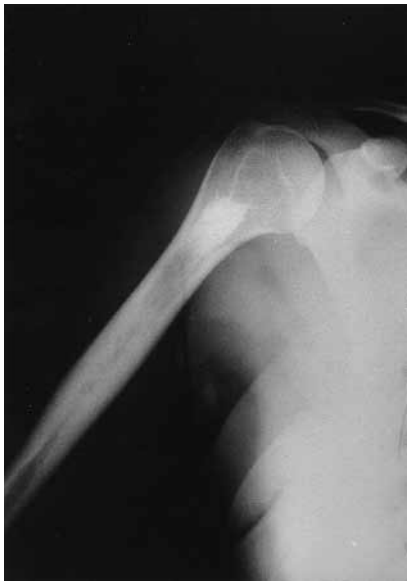

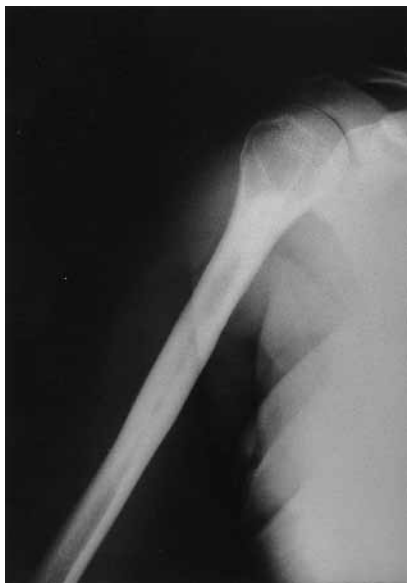

Figure 1 Anterior **(A)** and lateral **(B)** radiographs of the right humerus. Note the intramedullary sclerotic lesion in the proximal humerus and the more diffuse sclerotic lesion with adjacent cortical hypertrophy in the mid shaft.

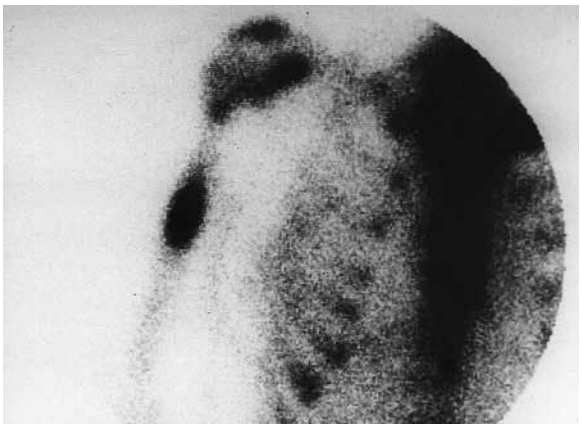

Figure 2 A technetium-99m–labeled 3-phase bone scan with 2 areas of increased activity in the proximal humerus that correspond to the lesions seen on plain films.

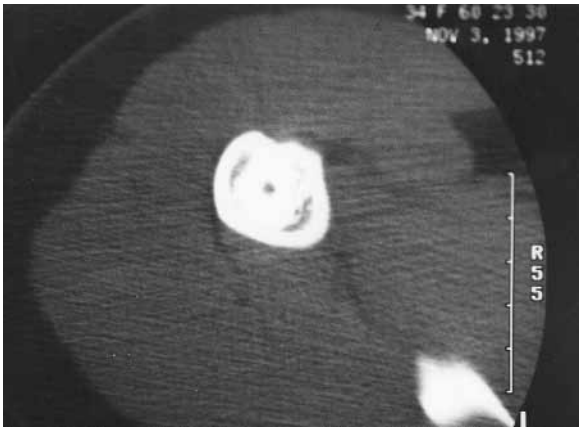

Figure 3 Computed tomography scan through the right humerus. Note that there is extensive medullary sclerosis and no cortical erosion.

lar plasma cell infiltrate intermixed with neutrophils. These findings of reactive and sclerotic bone with heavy plasma cell infiltration were consistent with acute and chronic inflammation as is caused by an infectious process.

The patient had an uneventful postoperative course. She was placed on 6 weeks of oral ciprofloxacin, 750 mg twice a day. Her follow-up examination 9 weeks later revealed complete resolution of symptoms and a complete recovery.

DISCUSSION

Garre first used the term *sclerosing, nonpurulent osteomyelitis* in 1893 to describe 1 of 10 different forms or complications of acute osteomyelitis.[19] The anatomic, laboratory, radiographic, and histologic findings are nonspecific and can pose a diagnostic challenge, but several subtypes have been described.[3,7,8,13,15] Common features among the various subtypes include the absence of acute initial symptoms combined with a protracted course of low-grade symptoms, the absence of pus or fistula formation, normal or mildly elevated leukocyte counts and erythrocyte sedimentation rates, the presence of sclerosis on x-ray, and nonspecific chronic inflammation on histology.[3,7,8,13,15] What differs among the subtypes is the anatomic location, the number of sites involved, the identification of an organism, the disease progression, and the clinical course.

While the cause in many cases remains unclear, the leading theory seems to suggest an occult infection.[4,5] Review of the English literature over the last 50 years, however, reveals that cultures have been positive in only 7 of 85 cases in lesions involving bones other than the mandi-

ble.[2-6,8-13,15,18,19] Sampling errors or the indolence of the process may contribute to the low incidence of culture positivity. For example, despite the proximity of the 2 lesions in this case, only 1 culture was positive.

This case of sclerosing osteomyelitis was atypical for several reasons. The first was the severity of sclerosis, both radiographically and grossly. The second unusual feature was the bacteriology. *Flavobacterium,* a gram-negative rod found in soil and water, is an uncommon, opportunistic pathogen that may cause meningitis and sepsis in premature infants. There are no previous reports of an association between *Flavobacterium* and osteomyelitis. Similarly, *Shigella* species, which usually cause infections of the gastrointestinal tract, are rarely associated with orthopaedic infections. The 4 reported orthopaedic cases of *Shigella* osteomyelitis all have features consistent with acute osteomyelitis,[1,14,16,17] in contrast to the insidious nature of this case. Given the rare and opportunistic nature of *Flavobacteria* and *Shigella,* one would expect that our patient had been immunocompromised. The fact that she was not immunocompromised at the time of infection further highlights the peculiarity of the case. A final distinguishing feature of this case was the heavy plasma cell infiltrate. Plasma cell osteomyelitis is an uncommon histologic variant,[15,18] and previously reported cases have been associated with *Staphylococcus aureus* and with osteolysis, rather than sclerosis.[15,18]

In summary, chronic plasma cell osteomyelitis is a rare condition with nonspecific findings and an unclear cause. The clinical and radiographic features may make it impossible to distinguish from other sclerotic lesions of bone. This unusual case exemplifies the need for a thorough history, physical, and careful work-up. It also illustrates the importance of multiple bone biopsies, particularly when dealing with such an indolent process. We advocate a comprehensive treatment strategy that includes multiple bone biopsies from several different areas of the same lesion or from regions in close proximity, followed by a complete course of culture-specific antibiotics.

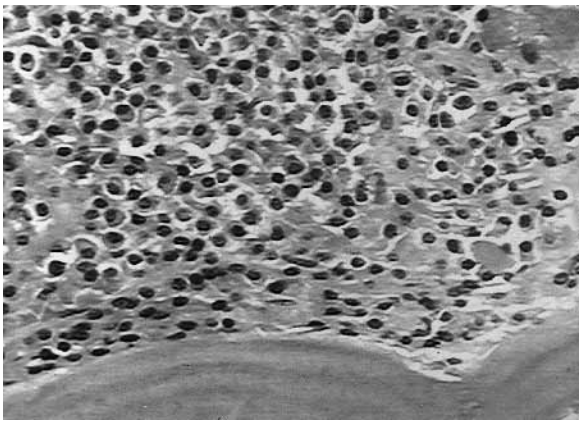

Figure 4 Histologic appearance of biopsy specimen from the diaphysis of the right humerus, showing heavy infiltration with plasma cells.

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